

IN THE CLAIMS:

- 1 1. (CURRENTLY AMENDED) A method for integrating traffic shaping and link sharing
2 functions to enable scaling of a plurality of queues multiplexed to media links of an in-
3 termediate station in a computer network, the queues storing data packets that are des-
4 tined for the media links, the method comprising the steps of:
5 assigning committed information bit rate (CIR) and excess information bit rate
6 (EIR) bandwidth values per queue, along with a shaped maximum bit rate per media link;
7 uniformly scaling the EIR bandwidths of all queues sharing a media link so that
8 the sum of all scaled EIR bandwidths equals an available bandwidth of the shaped media
9 link;
10 calculating when a queue is next eligible for servicing; and
11 storing event notifications in a timing wheel, each event notification having a
12 hash entryies identifying a queue, a media link, and a priority, the event notifications ~~are~~
13 triggered when a queue is eligible for servicing.
- 1 2. (ORIGINAL) The method of Claim 1 wherein the step of storing comprises the step of
2 providing a timing wheel having a plurality of fields per time slot, wherein the fields rep-
3 resent different service priorities of queues.
- 1 3. (PREVIOUSLY PRESENTED) The method of Claim 2 wherein the step of providing
2 a timing wheel comprises the step of configuring pointers to the queues to thereby obvi-
3 ate overhead incurred when searching the timing wheel for other references to the pack-
4 ets.
- 1 4. (ORIGINAL) The method of Claim 3 wherein the step of providing a timing wheel
2 further comprises organizing the timing wheel as a contiguous array of time slots contain-
3 ing pointers to linked lists.

1 5. (ORIGINAL) The method of Claim 4 wherein the contiguous array is a hash array and
2 wherein the linked lists are hash lists.

1 6. (ORIGINAL) The method of Claim 3 wherein the step of providing a timing wheel
2 further comprises organizing the timing wheel as a descriptor ring having a plurality of
3 per-time-slot queues.

1 7. (CURRENTLY AMENDED) A system for integrating traffic shaping and link sharing
2 functions to enable scaling of a plurality of queues multiplexed to media links of an in-
3 termediate station in a computer network, the queues storing data packets that are des-
4 tined for the media links, the system comprising:

5 queuing logic configured to organize the queues into class queues of a plurality of
6 queue sets, each queue set coupled to inputs of a sublink multiplexer having an output
7 coupled to a media link via a media link queue; ~~and~~

8 a queue scheduler configured to assign each class queue committed information
9 bit rate (CIR) and excess information bit rate (EIR) bandwidths, and the media link a
10 shaped maximum bit rate; and

11 the queue scheduler further including a timing wheel organized as a descriptor
12 ring with time slots, wherein each time slot includes a queue-depth index that references
13 a tail of a list of queue descriptors associated with that time slot, each queue descriptor of
14 the list of queue descriptors to indicate that a particular class queue is eligible for servic-
15 ing.

1 8. (ORIGINAL) The system of Claim 7 wherein the queue scheduler comprises a EIR
2 scaler that uniformly scales the EIR bandwidths of all queues sharing a media link so that
3 the sum of all scaled EIR bandwidths equals an available bandwidth of the shaped media
4 link.

1 9. (ORIGINAL) The system of Claim 8 wherein the queue scheduler further comprises a
2 virtual time policer (VTP) configured to determine whether the media links are compliant
3 and to calculate when a queue is next eligible for servicing.

1 10. (CANCELLED)

1 11. (CANCELLED)

1 12. (CURRENTLY AMENDED) The system of Claim-~~11~~ 7 wherein the queue descrip-
2 tors include a queue index that references a class queue of the queuing logic.

1 13. (CURRENTLY AMENDED) The system of Claim-~~12~~ 7 wherein the queue descrip-
2 tors include a media link interface that references a media link coupled to the intermedi-
3 ate station.

1 14. (CURRENTLY AMENDED) The system of Claim-~~12~~ 7 wherein the queue descrip-
2 tors include a priority value indicating a priority level assigned to a queue.

1 15. (CANCELLED)

1 16. (CANCELLED)

1 17. (CURRENTLY AMENDED) A method for integrating traffic shaping and link shar-
2 ing functions to enable scaling of a plurality of queues multiplexed to media links of an
3 intermediate station in a computer network, the queues storing data packets that are des-
4 tined for the media links, the method comprising the steps of:

5 notifying a queue scheduler when each packet is forwarded to a queue;
6 determining if the queue is ~~inactive for~~ using a committed information bit rate
7 (CIR) and ~~for~~ if the queue is using an excess information bit rate (EIR);

8 if the queue is ~~inactive for not using~~ the CIR, ~~activating making use of~~ the CIR
9 and ~~incrementing including such use in an~~ calculated aggregate CIR bandwidth for a me-
10 dia link;

11 if the queue is ~~not inactive for using~~ the CIR, ~~activating making use of~~ the EIR
12 ~~rate and including such use in incrementing a calculated~~ the aggregate EIR bandwidth for
13 the media link; and

14 calculating an EIR scale factor of the media link.

1 18. (PREVIOUSLY PRESENTED) The method of Claim 17 further comprising the
2 steps of:

3 retrieving a queue descriptor from a timing wheel, wherein the queue descriptor
4 includes a queue index, a media link interface , and a priority value;

5 comparing a calculated link VTP timestamp of a media link queue with a current
6 real time and burst value to ensure that collisions between an eligible queue and other
7 queues do not cause the media link queue to exceed a configurable limit;

8 if the media link queue does not exceed the configurable limit, issuing a dequeue
9 command to the queuing logic for the eligible queue;

10 in response to the command, dequeuing a packet from the eligible queue;

11 returning a length of the dequeued packet as dequeue status to the queue sched-
12 uler; and

13 if the queue length is non-zero, sending the dequeued packet to a media controller
14 for loading into the media link queue.

1 19. (ORIGINAL) The method of Claim 18 further comprising the steps of:

2 periodically sending depth threshold status of the media link queue to the queue
3 scheduler;

4 if the depth threshold status indicates that there are more bits in the media link
5 queue than the link VTP timestamp represents, incrementing the link VTP timestamp;

6 correlating the dequeue status with the issued dequeue command;

7 if a dequeued byte count is non-zero, marking the queue as eligible for servicing;
8 if the dequeued byte count is zero, deactivating one of the CIR and EIR of the
9 queue; and
10 decrementing one of the CIR and EIR aggregate bandwidths of the link.

1 20. (CANCELLED)

1 21. (CURRENTLY AMENDED) A method for operating an intermediate station, comprising:
2

3 dividing the intermediate station into a plurality of queues multiplexed to a plurality of media links, the queues storing data packets that are destined for the media links;

4 storing event notifications in lists associated with a plurality of time slots within a timing wheel to indicate when a queue is eligible for servicing, ~~where each event notification~~
5 ~~time slot in the plurality of time slots including~~ es a hashed entry, the hashed entry
6 identifying a queue index (Q), a media link interface (I), and a priority value (P) for each
7 queue; and
8

9 upon a ~~time ing~~ slot in the plurality of time slots becoming a current time slot,
10 checking each ~~entry~~ event notification in ~~a the~~ list associated with the time slot, to determine which packets to send.
11
12

1 22. (CURRENTLY AMENDED) The method of Claim 21 further comprising:

2 storing ~~similar entries~~ event notifications for the same queue at a first time slot
3 and a second time slot, where the second time slot is further in the future than the first
4 time slot, ~~and the event notification an entry~~ at the second time indicates ~~is~~ a higher priority then the event notification an entry at the first time slot.
5

1 23. (CANCELLED)

1 24. (NEW) A system for integrating traffic shaping and link sharing in a network de-
2 vice, the system comprising:

3 queuing logic configured organize a plurality of class queues into a plurality of
4 queue sets, each class queue associated with a particular type of data and, each queue set
5 coupled to a particular media link of a plurality of media links; and

6 a queue scheduler configured to assign each class queue a committed information
7 bit rate (CIR) and a excess information bit rate (EIR) bandwidth, the EIR bandwidth
8 scaled so that the sum of all scaled EIR bandwidths of all the class queues of a queue set
9 does not exceed an available bandwidth of the shaped media link coupled to the queue
10 set,

11 the queue scheduler further including a timing wheel organized as a descriptor
12 ring with time slots, wherein each time slot includes a queue-depth index that references
13 a tail of a list of queue descriptors associated with that time slot, each queue descriptor of
14 the list of queue descriptors to indicate that a particular class queue is eligible for servic-
15 ing.

1 25. (NEW) The system of Claim 24 wherein each queue descriptor comprises a queue
2 index that specifies the class queue eligible for servicing.

1 26. (NEW) The system of Claim 24 wherein each queue descriptor comprises a media
2 link interface that specifies the media link coupled to queue set that includes the class
3 queue eligible for servicing.

1 27. (NEW) The system of Claim 24 wherein each queue descriptor comprises a priority
2 value that specifies a priority level assigned to the class queue eligible for servicing.

1 28. (NEW) The system of Claim 24 further comprising:

2 a virtual time policer (VTP) configured to determine whether utilization of buffers
3 associated with the media links exceed configurable limits and to calculate when each
4 class queue is next eligible for servicing.

1 29. (NEW) A method for integrating traffic shaping and link sharing in a network de-
2 vice, the method comprising:

3 organizing a plurality of class queues into a plurality of queue sets, each class
4 queue associated with a particular type of data and, each queue set coupled to a particular
5 media link of a plurality of media links;

6 assigning each class queue a committed information bit rate (CIR) and a excess
7 information bit rate (EIR) bandwidth;

8 scaling each EIR bandwidth so that the sum of all scaled EIR bandwidths of all
9 the class queues of a queue set does not exceed an available bandwidth of the shaped me-
10 dia link coupled to the queue set; and

11 indicating when class queues are eligible for servicing with a timing wheel organ-
12 ized as a descriptor ring with time slots, each time slot including a queue-depth index that
13 references a tail of a list of queue descriptors associated with that time slot, each queue
14 descriptor of the list of queue descriptors indicating that a particular class queue is eligi-
15 ble for servicing.

1 30. (NEW) The method of Claim 29 wherein each queue descriptor indicates the class
2 queue eligible for servicing.

1 31. (NEW) The method of Claim 29 wherein each queue descriptor indicates the media
2 link coupled to queue set that includes the class queue eligible for servicing.

1 32. (NEW) The method of Claim 29 wherein each queue descriptor indicates a priority
2 level assigned to the class queue eligible for servicing.

1 33. (NEW) The method of Claim 29 further comprising:
2 determining whether utilization of buffers associated with the media links exceed
3 configurable limits; and
4 calculating when class queues are next eligible for servicing.

1 34. (NEW) A system for integrating traffic shaping and link sharing in a network de-
2 vice, the system comprising:
3 means for organizing a plurality of class queues into a plurality of queue sets,
4 each class queue associated with a particular type of data and, each queue set coupled to a
5 particular media link of a plurality of media links;

6 means for assigning each class queue a committed information bit rate (CIR) and
7 a excess information bit rate (EIR) bandwidth;

8 means for scaling each EIR bandwidth so that the sum of all scaled EIR band-
9 widths of all the class queues of a queue set does not exceed an available bandwidth of
10 the shaped media link coupled to the queue set; and

11 means for indicating when class queues are eligible for servicing with a timing
12 wheel organized as a descriptor ring with time slots, each time slot including a queue-
13 depth index that references a tail of a list of queue descriptors associated with that time
14 slot, each queue descriptor of the list of queue descriptors indicating that a particular
15 class queue is eligible for servicing.